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10/598,529	06/08/2007	Masahiko Hamanaka	G0126.0248	6957

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EXAMINER	
KOZIOL, STEPHEN R	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/598,529	HAMANAKA, MASAHIKO	
	Examiner	Art Unit	
	STEPHEN R. KOZIOL	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 October 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6-8,11-13 and 16-47* is/are rejected.

7)☒ Claim(s) *4,5,9,10,14 and 15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 September 2010* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. Applicant's response filed 26 October 2010 has been entered and considered, but is not found convincing. Claims 1, 6, 7, 11, 16, 18-20 and 24-47 have been amended without introducing new subject matter. No new rejections are set forth herein; therefore, this action is made Final.

Response to Applicant's Remarks

2. 35 USC § 101

Claims 24-29, 32, 35, 38, 41, 44 and 47 were rejected under 35 USC § 101 for failing to recite patentable subject matter. Applicant has since amended the independent claims remedy the '101 issues noted in the previous action; therefore, the previously outstanding grounds of rejection under 35 USC §101 are hereby withdrawn.

3. 35 USC § 112 ¶2

Claims 1-47 were rejected under 35 USC § 112 for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant has since amended the claims to remedy the indefiniteness issues noted in the previous action; therefore, the previously outstanding grounds of rejection under 35 USC §112 are hereby withdrawn.

4. 35 USC § 103

Claims 1-3, 6-8, 11-13 and 16-47 were rejected in view of the combination of Ishiyama and Kohno. Applicants traverse this rejection arguing that neither Ishiyama nor Kohno teach the limitation of "a first sharpness extraction unit for extracting a first sharpness amount reflecting the sharpness from each of the plurality of comparison images" as recited throughout the similar independent claims. Specifically, Applicants note that in the claims the sharpness amount is

extracted from the comparison or generated image while Kohno uses external environment information to determine a similarity between images (see Remarks, pp. 18, 10/26/2010). Applicants conclude that neither Ishiyama nor Kohno teach the sharpness extraction limitation.

Examiner respectfully disagrees. Ishiyama is relied upon to teach the limitation of generating a comparison image (see ¶¶0045-46, where Ishiyama calculates differences between a projected image and a pose candidate). Applicants correctly note that Ishiyama is silent on further extracting sharpness from the comparison image, as claimed. However, Kohno is introduced as an improvement to Ishiyama's system at least because Kohno teaches the concept of using a weighted sharpness extraction value when determining image similarities (see Kohno ¶¶0045-46). Kohno and Ishiyama are both drawn to image similarity determination systems and so the ordinarily skilled artisan would have had ample motivation to combine them. Such a combination (as originally proposed in the non-final action mailed 08/13/2010) would have modified Ishiyama's generated comparison image by applying Kohno's weighted sharpness value extraction method. The resulting combination teaches "a first sharpness extraction unit for extracting a first sharpness amount reflecting the sharpness from each of the plurality of comparison images" as recited throughout the similar independent claims.

Therefore, the combination of Ishiyama and Kohno is understood to teach each and every limitation of claims 1-3, 6-8, 11-13 and 16-47, and the previously outstanding rejections thereto are maintained.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in Graham **v.** John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-3, 6-8, 11-13, 16-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishiyama U.S. Pre-Grant Application Publication No. 2003/0035098 ("Ishiyama") in view of Kohno U.S. Pre-Grant Application Publication No. 2003/0161535 ("Kohno").

Regarding similar independent claims 1 (system), 11 (system), 16 (method), 20 (method), 24 (program) and 28 (program) Ishiyama teaches a pose estimation system for performing object pose estimation by comparing an input image with a three-dimensional object model (see Figs. 3-5 *and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)*, the pose estimation system comprising:

i. an pose candidate decision unit for generating at least one pose candidate (see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed);

ii. a comparison image generation unit for generating, according to the generated pose candidate, a plurality of comparison images similar to the input image, while projecting the three-dimensional object model to a two-dimensional image (see Ishiyama Fig. 3 as described in ¶¶0044-45 where images are projected onto a pose candidate);

iii. a difference calculator for calculating a plurality of differences (see Ishiyama Fig. 3 as described in ¶¶0045-46 where differences between the projected images and the pose candidate are calculated); and

iv. a determination unit for selecting a comparison image having the smallest difference among the plurality of differences and estimating an optimal pose based on the selected comparison image (see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).

Ishiyama is silent on the system further comprising a first sharpness extraction unit for extracting a first sharpness amount reflecting the sharpness from each of the plurality of comparison images, and a weighted difference calculator, as claimed. However, Kohno teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing (see Kohno ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity).

The ordinarily-skilled artisan, starting with the pose estimation system of Ishiyama, would have appreciated the benefits of using a weighted measure of sharpness to determine pose similarity, as proposed by Kohno in ¶¶0065-66. The resulting combination of Ishiyama and Kohno would achieve the predictable and expected benefits of increasing the accuracy of the pose estimation by incorporating a measure of image sharpness. The artisan of ordinary skill would have been motivated to combine Kohno with Ishiyama, as proposed above, at least because both Kohno and Ishiyama are drawn to similar image matching systems, and so the similarities between Kohno and Ishiyama invite further modifications between the two.

Therefore, a person having ordinary skill in the image processing arts at the time of the invention would have found it obvious to combine the weighted sharpness values of Kohno, with the pose estimation system of Ishiyama to achieve the well-known and expected benefits of increasing the accuracy of the pose estimation by incorporating a measure of image sharpness.

Regarding similar claims 2 (system), 12 (system), 17 (method), 21 (method), 25 (program) and 29 (program) Ishiyama and Kohno teach the method as indicted re claim 1 above, but are silent on the method further comprising a second sharpness extraction unit for extracting a second sharpness amount reflecting the sharpness from the input image, wherein the weighted difference calculator calculates a plurality of weighted differences by weighting the difference between the second sharpness amount of the input image and the first sharpness amount of each of the comparison images to the difference between the input image and the comparison image. However, official notice is taken to note that the uses and benefits of using a second sharpness extractor are well known and expected in the image processing arts (and Kohno already teaches a first sharpness extractor, as indicated re claim 1 above). It would have been obvious to the artisan of ordinary skill at the time of the invention to use the results from a second sharpness extractor within the system of Ishiyama and Kohno as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 3 (system), 8 (system), 13 (system), Ishiyama and Kohno teach the method as indicted re claim 1 above, but are silent on the method further comprising wherein the weight becomes higher as the sharpness of the image becomes higher in the weighted

difference calculation. However, official notice is taken to note that the uses and benefits of using a variable weight are well known and expected in the image processing arts (and Kohno already teaches a weighted first sharpness value, as indicated re claim 1 above). It would have been obvious to the artisan of ordinary skill at the time of the invention to use a variable weighted sharpness result within the system of Ishiyama and Kohno as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 6 (system), 7 (system), 26 (program) and 27 (program), Ishiyama and Kohno teach the method as indicted re claim 1 above, but are silent on the method further comprising wherein the determination unit further performs object comparison by comparing the minimum weighted difference of the estimated optimal pose with a predetermined threshold value. However, official notice is taken to note that the uses and benefits of using a predetermined threshold in pose estimation are well known and expected in the image processing arts. It would have been obvious to the artisan of ordinary skill at the time of the invention to use a predetermined threshold within the system of Ishiyama and Kohno as described re claim 1 above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Regarding similar claims 18 (method) and 19 (method), Ishiyama further teaches selecting a comparison image having the smallest weighted difference among the plurality of weighted differences; and estimating an optimal pose based on the selected comparison image (see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).

Regarding similar claims 22 (method) and 23 (method), Ishiyama further teaches difference calculation method according to claim 20, further comprising: performing comparison by comparing the plurality of weighted differences obtained by the calculation (see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).

Regarding similar independent claims 30 (method), 36 (method) and 42 (method) Ishiyama teaches object pose/illumination estimation method (see Figs. 3-5 and ¶¶0010 and *0026 for an overview of Ishiyama's pose estimation system)* for estimating at least one of the pose and the illumination conditions of an object (see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed) by generating a two-dimensional image of the object while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object(see Ishiyama Fig. 3 as described in ¶¶0044-45 where images are projected onto a pose candidate).

Ishiyama is silent on the system wherein sharpness of the generated two-dimensional image is reflected in the similarity, as claimed. However, Kohno teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing (see Kohno ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity). Motivation to combine Ishiyama and Kohno to achieve the results of claim 30, 36 and 42 can be found re similar claim 1 above.

Regarding similar independent claims 31 (system), 37 (system) and 43 (system) Ishiyama teaches an image generation unit for generating a two-dimensional image of an object (see Figs.

3-*5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)* while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object (see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed); a calculator for calculating the similarity by comparing the generated two-dimensional image with an input image (see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).

Ishiyama is silent on the system further comprising an extraction unit for extracting sharpness from the generated two-dimensional image and reflecting the extracted sharpness in the calculation; and a determination unit for estimating at least one of the pose and the illumination conditions based on the calculation result of the calculator, as claimed. However, Kohno teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing (see Kohno ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity). Motivation to combine Ishiyama and Kohno to achieve the results of claim 31, 37 and 43 can be found re similar claim 1 above.

Regarding similar independent claims 32 (system), 38 (system) and 44 (system) Ishiyama teaches image generation processing for generating a two-dimensional image of the object (see Figs. 3-*5 and ¶¶0010 and 0026 for an overview of Ishiyama's pose estimation system)* while changing at least one of the pose and the illumination conditions of the object with the use of a three-dimensional model of the object (see Ishiyama Fig. 3 as described in ¶¶0040-41 where a pose estimation routine is disclosed); calculation processing for calculating the similarity by

comparing the generated two-dimensional image with an input image (see Ishiyama Fig. 3 item 310 as described in ¶0047 where the image candidate whose distance to the input image is smallest is selected).

Ishiyama is silent on the system further comprising extraction processing for extracting sharpness from the generated two-dimensional image, and reflecting the extracted sharpness in the calculation, as claimed. However, Kohno teaches a similar image similarity determination system comprising using a measure of sharpness (e.g., a degree of camera blur when acquiring an image) in similarity determination processing (see Kohno ¶¶0065-66, where weighted sharpness (i.e. blurring) values are used to determine image similarity). Motivation to combine Ishiyama and Kohno to achieve the results of claim 32, 38 and 44 can be found re similar claim 1 above.

Regarding similar claims 33 (method), 34 (system), 35 (program), 39 (method), 40 (system), 41 (program), 45 (method), 46 (system) and 47 (program), Ishiyama and Kohno teach a pose estimation system but are silent on the system further comprising wherein, if the two-dimensional image having the highest similarity in brightness is not, sharp the estimation to the input image is not employed. However, official notice is taken to note that the uses and benefits of varying the sharpness estimation based upon similarity are well known and expected in the image processing arts. It would have been obvious to the artisan of ordinary skill at the time of the invention to vary the sharpness estimation based upon similarity within the system of Ishiyama and Kohno as described above, to achieve the known and expected uses and benefits of increasing the accuracy of the resulting pose estimation.

Claim Objections

7. Claims 4-5, 9-10, and 14-15 would be allowable if rewritten to include all the limitations of their respective base claims and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: Regarding similar dependent claims 4-5, 9-10, and 14-15 the prior art of record, alone or in combination, fails to fairly teach of suggest the limitations of: wherein the first and second sharpness amounts are defined by a ratio of a number of pixels whose edge intensity is a threshold value or higher to the total number of pixels, a range of brightness values, dispersion of brightness values, or a number of characteristic points, and wherein the first and second sharpness amounts are defined by an edge image or a characteristic point, as recited in the claims

Conclusion

9. No new grounds of rejection set forth herein; accordingly, this action is made final. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steve Koziol:

- phone (571) 270-1844, fax (571) 270-2844, or e-mail stephen.koziol@uspto.gov.

Typically, the examiner can be reached Monday - Friday 9:00 - 5:30 EST. For e-mail communications, please note MPEP 502.03, which states, in relevant part, "[w]ithout a written authorization by applicant in place, the USPTO will not respond via Internet e-mail to any Internet correspondence which contains information subject to the confidentiality requirement as set forth in 35 U.S.C. § 122." A sample authorization form which may be used by applicant can be found in MPEP 502.03 section II.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached at (571) 272-74 53. Customer Service can be reached at (571) 272-2600. The fax number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/srk/
30 December 2010
/Jingge Wu/
Primary Patent Examiner, Art Unit 2624